Implementing SRM V2.2 functionality in dCache


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Project Topology : The Team

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Project Topology: Partners

Code contribution

besides DESY, FERMI

NDGF : ftp (protocol V2)

IN2P3 : HoppingManager

Integration. Verification

- CERN
- Open Science Grid
- d-Grid

SRM V1.1 interface

- SRM V1.1 has been a part of dCache for over 4 years
- Used in production by US-CMS for over 2 years
- Solid protocol **but**
- Did not include
  - Explicit Space Reservation and Management
  - Directory functions
  - File Access Permission management
  - Abstractions to describe type and quality of service
- Weak Error and status reporting
- SRM 2 addressed many of the issues

LHC needs

- Common interface to T0, T1 and T2 storage
- Guarantee of space availability
  - Space Reservation
- Storage Class differentiation
  - Access Latency and Retention Policy
- Flexible Namespace management
  - Directory Functions
- ACL Support
  - Permission management functionality
- SRM V2.2 was the answer

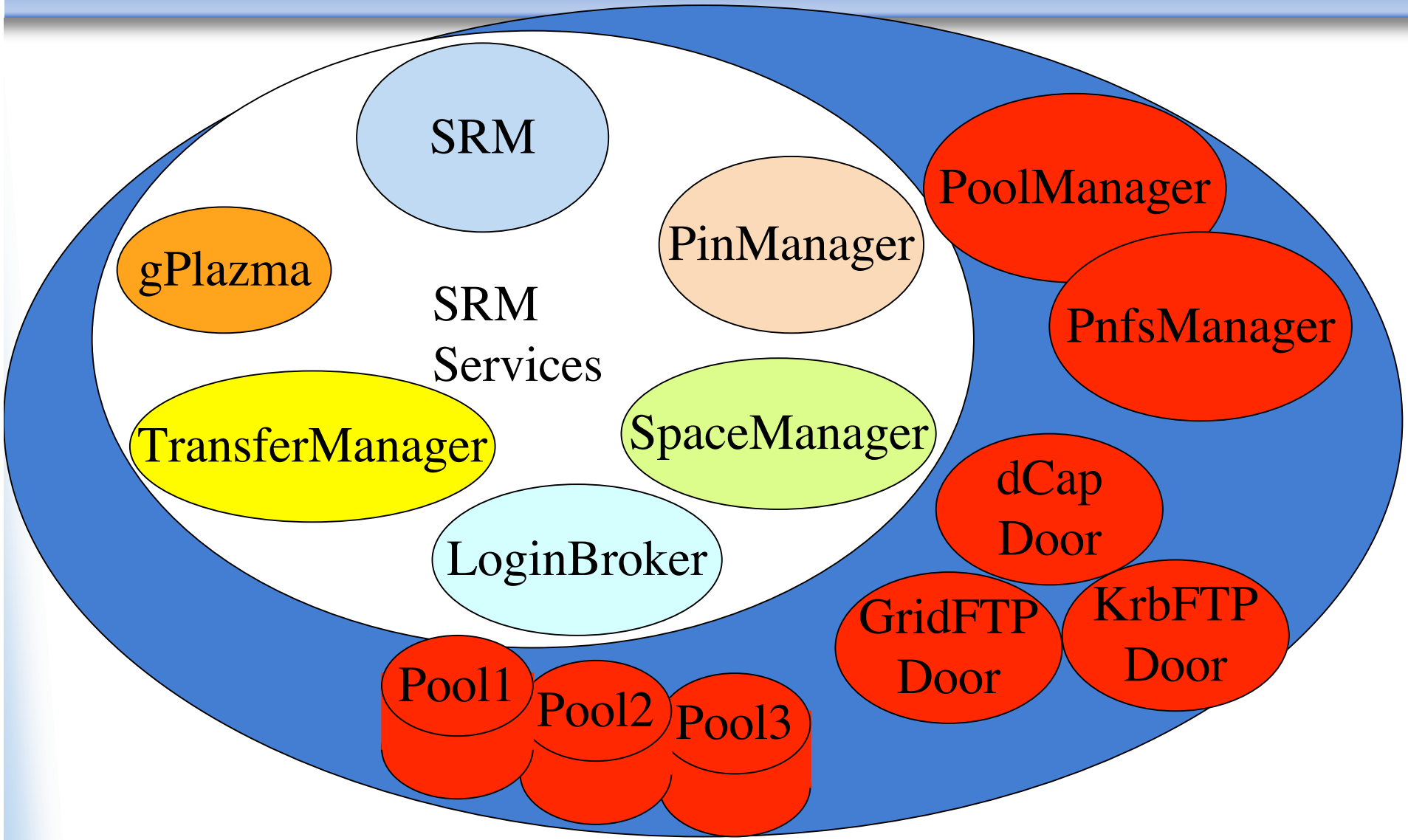
dCache SRM v2.2 history

- Prototype of SRM 2.0 interface demonstrated at SC 2003
- Work on dCache SRM 2.x since late 2004
- LHC experiments input led to SRM 2.2 definition
- In May 2006 WLCG chose a subset of SRM v2.2 which became a dCache project target
- Beta of dCache 1.8 with SRM 2.2 released in April 2007
- October 2007 – Production release

SRM dCache Services

- LoginBroker – a service for the discovery of all dCache Doors (a transfer protocol incarnation deployed on a given host:port) and their loads
- PinManager – a service for staging and pinning files (Control of online state)
- Space Manager – a Service that supports advanced Space Reservation and management
- Pool Repository and Namespace are modified to better support “pin in Cache” operation and “Online” file parameters
- Transfer Managers supervise “srmCopy” storage to storage transfers
- gPlazma Grid Access control service provides support for VO Based Authorization

SRM Services in DCache



LoginBroker

- SRM supports protocol negotiation, dynamic TURL allocation and Load Balancing
- dCache LoginBroker
  - Knowledge of all protocol access points a.k.a. dCache Doors
  - Advertises door instant load and maximum capacity
- dCache SRM uses this to discover supported protocols and calculate TURL of the least loaded access point (host:port)
- Support of new protocols does not require dCache SRM modifications

PinManager

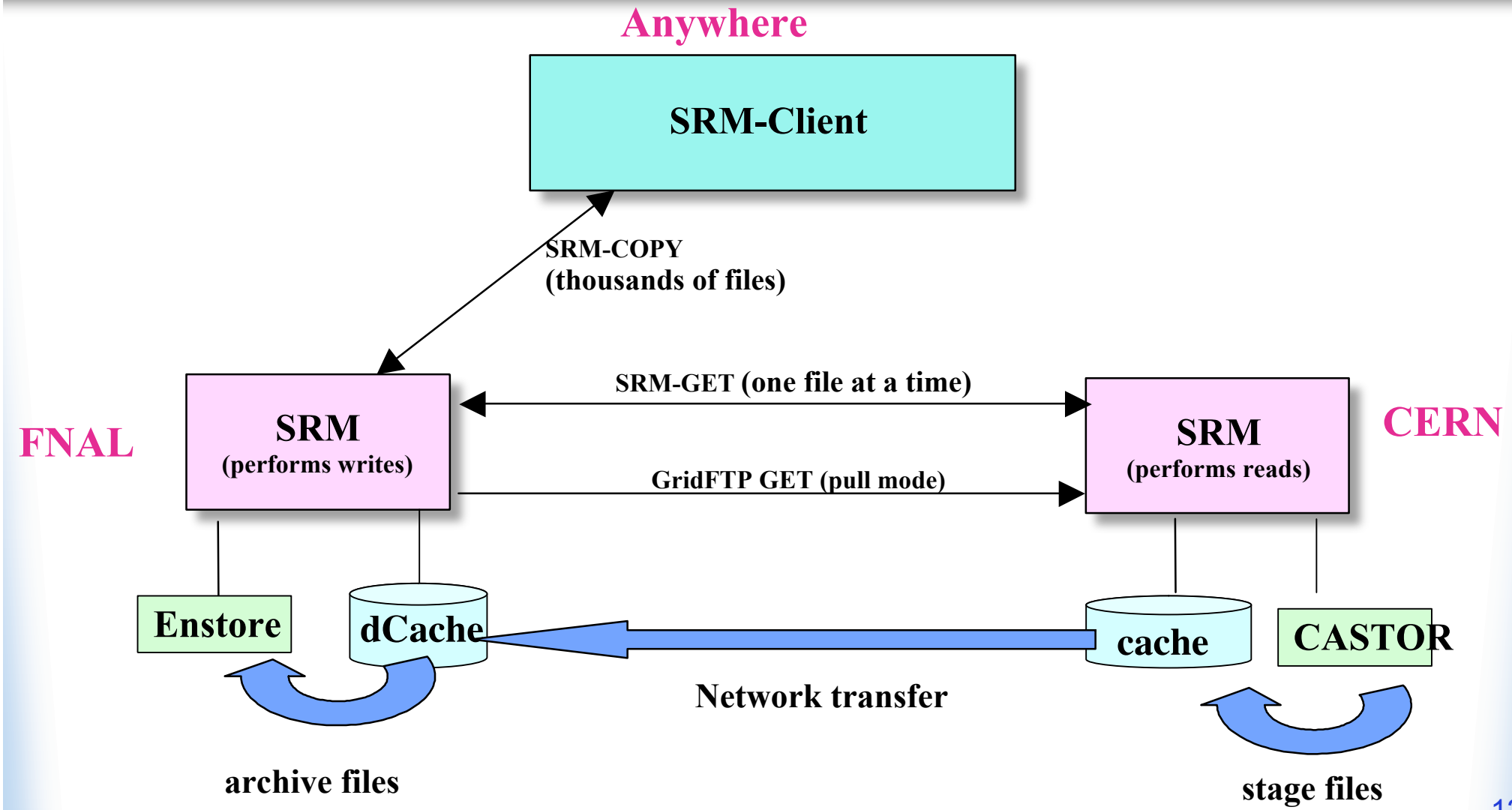
- SRM V1.1/2.2 implicit Pinning and SRM V2.2 BringOnline functionality requires advanced HSM cache management capabilities
- dCache PinManager
  - Stage and Pin functionality
  - Supports Pin lifetimes
  - Multiple logical pins mapped to a single dCache pin
  - Interface between SRM and dCache Pools and PoolManager

dCache support of Space Management

- SRM V2.2 Space Management functionality
  - Space Reservation
    - Size
    - Lifetime
    - AccessLatency (Online, Nearline) – Speed of access to the data
    - RetentionPolicy (Replica, Output, Custodial)*– quality of retention service
  - dCache had to
    - Update PoolManager pool selection mechanism
    - New Pool Repository code
    - SpaceManager module
      - dCache introduced a new way to partition total space according to their support of RetentionPolicy, AccessLatency and VO Groups/Roles.
      - Support for a streaming to HSM model

* WLCG interpretation: Replica – Disk, Custodial –Tape, Online Output – not used.

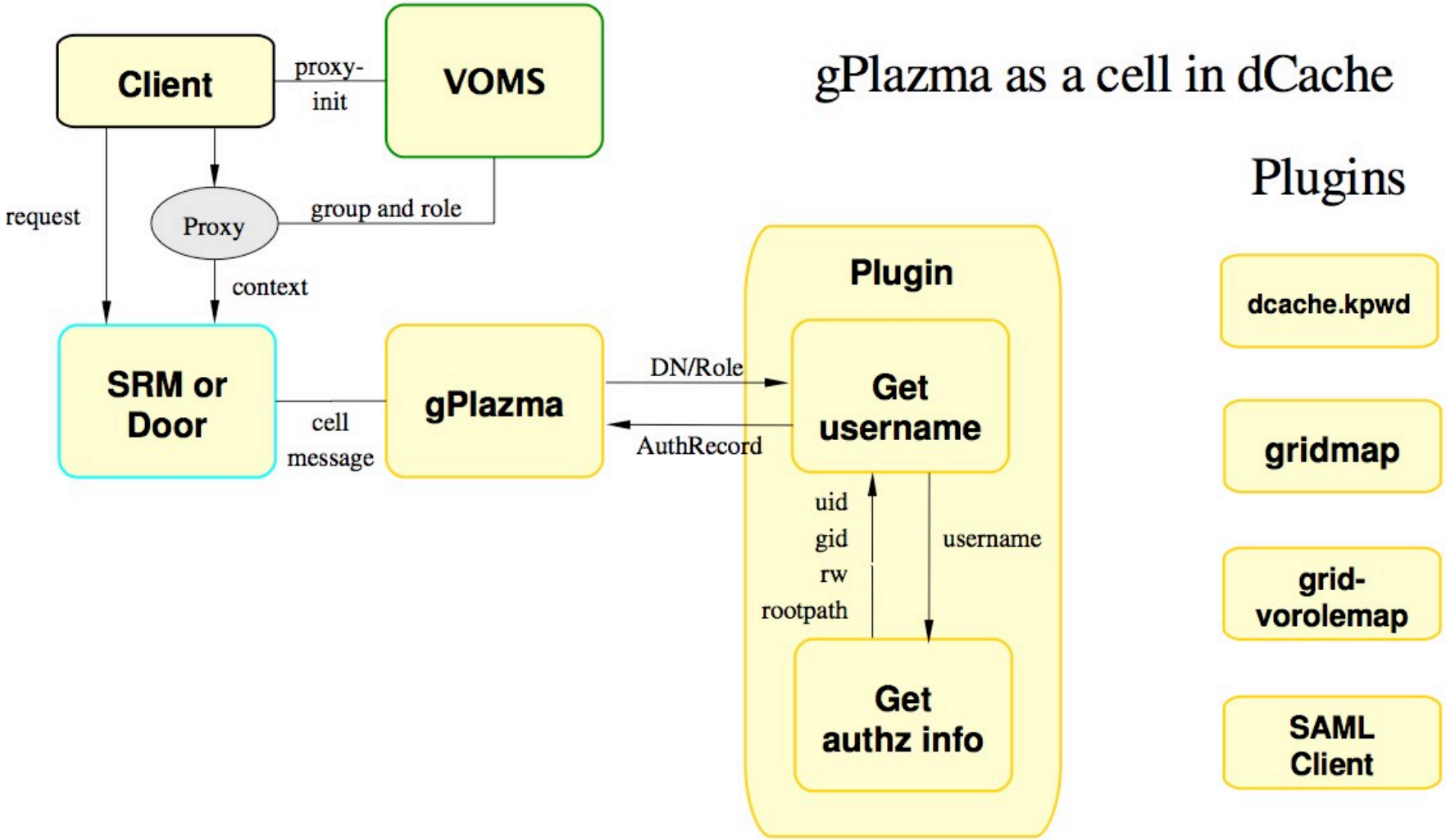
Robust Replication



Transfer Managers

- srmCopy function allows for a direct Storage to Storage transfer
- SRM Performs protocol and TURL negotiation with remote system using SrmPrepareToGet or SrmPrepareToPut functions
- dCache Transfer Managers manage individual transfers
  - Transfers are scheduled on dCache pools providing high scalability and transfer rates
  - Credential Management and delegation
  - FTP, Gridftp and http protocol support

gPlazma


Client
proxy-
init
VOMS
request
Proxy
group and role
context
SRM or
Door
cell
message
gPlazma
DN/Role
AuthRecord
Plugin
Get
username
uid
gid
rw
rootpath
username
Get
authz info
gPlazma as a cell in dCache
Plugins
dcache.kpwd
gridmap
grid-
vorolemap
SAML
Client

Access Control Mechanisms

- dCache Authorization (gPlazma)
  - Pluggable authorization service
  - Supports VO Certificate proxies
  - Multiple VO Memberships
- PNFS Namespace Service
  - Files are owned by a particular User and Group.
  - No ACL Support
- Chimera Namespace (currently in Beta testing)
  - Full ACL Support by Fall 2007
- SRM permission management functions
  - need both VO Authorization System and ACL capable Namespace Service
  - Full support of SRM Permission Management will follow

SRM 2.2 Status (1)

Basic WLCG MoU functionality

Missing 0 out of 25

WLCG MoU functionality due end of 2007

Missing 2 out of 4

Non MoU functionality

Missing 6 out of 12

Project internal stress tests show greatly improved performance. Need independent confirmation

SRM 2.2 Status (2)

- 1.8.0_14 released on Aug 24, 07
  - Resolved most URGENT issues
    - SrmMkdir, SrmRmDir, SrmRm Error Codes
    - Resolved Space Reservation VO base Access control and Performance issues
    - Support for Infinite Space Reservations, admin commands for Space Reservations in LinkGroups
    - Stability under stress tests

SRM Versions support in dCache 1.8

- **dCache 1.8.0** and higher will support **SRM 1.1 and SRM 2.2** at the same time on the same TCP Port.
- Both SRM protocol versions will run in the same dCache instance, using just one file system instance. (pnfs)
- Both SRM versions will have access to the **same file name space.**
- Files written with 1.1 can be accessed via 2.2 and vice versa.

Plans

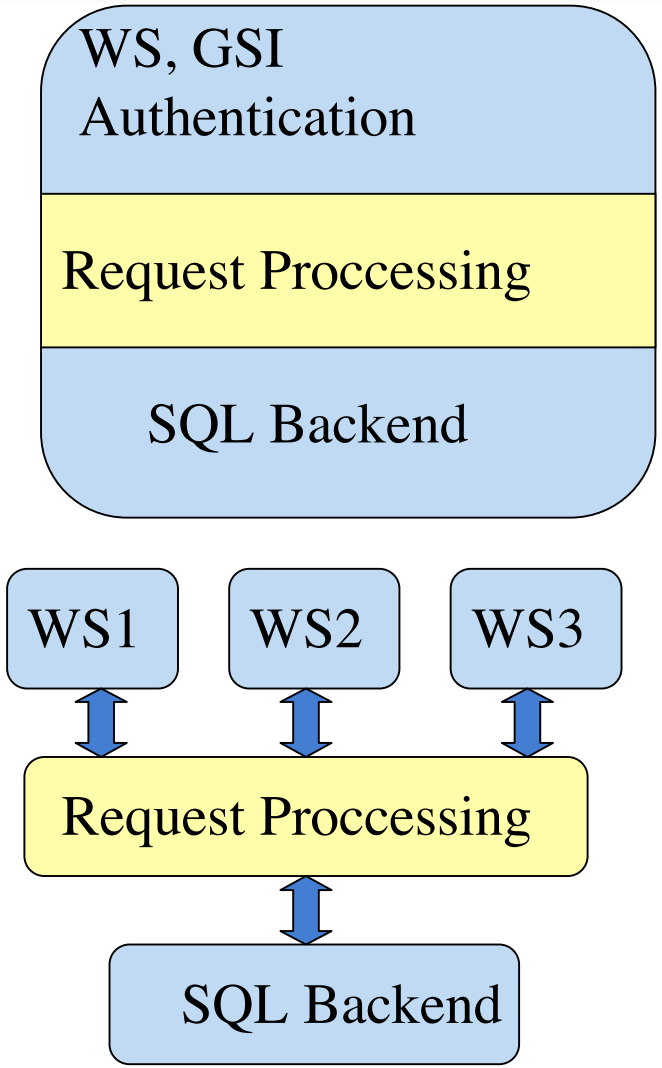
- Stability, WLCG Functionality
- SRM horizontal scaling
- Automatic File Removal after Space Expiration
- Permission Management
- Production quality srmcp client tool suite

Stability and Completion of WLCG Functionality

- First goal – stability and production quality of service provided by dCache 1.8 with SRM 1.1 and SRM 2.2
- SRM Scalability concerns will be addressed
  - Comprehensive stress testing
  - BNL – Horizontal Scalability
  - NDGF – GSI SSL optimization
- Implementation of srmChangeSpaceForFiles – early 2008

SRM Horizontal Scaling (BNL Contribution)

- SRM Interface dCache
  - WEB Service deployed in Tomcat/Axis
  - SQL database for Persistent State Storage
  - Monolith module
  - GSI Authentication – 90% CPU load
  - Does not scale to multi-nodes
- Work just began
  - Decuple Web Service interface from Business Logic
  - Allow multiple WS endpoints for a single system
  - This will enable usage of DNS Load Balancing



Automatic File Removal after Space Expiration (OSG Contribution)

- Open Science Grid (OSG) storage is open to opportunistic use by multiple experiments and organizations
- Requires ability to Guarantee that upon the expiration of the lease on disk space, it will be automatically cleaned up
  - Files in the expired Space will be removed (garbage collected) via administrative tools (or automatically)
- OSG Contribution will help add support for volatile files with managed lifetimes
- SRM SpaceManager will be used for enabling this functionality

SRM Permission Management

- need both VO Authorization System (gPlazma, done) and ACL capable Namespace Service (Chimera, Fall 07)
- Full support of SRM Permission Management will follow

SRMCP Client tool suite

- SRMCP tool suite includes
  - Srm V1.1 clients – production quality
  - Srm V2.2 clients – requires some development, documentation
- dCache 1.7 rpm clients **will not** work with dCache 1.8 SRM 2.2 interface (will work with 1.8 SRM V1.1)
- dCache 1.8 rpm client will work with dCache 1.7 SRM V1.1 interface and dCache 1.8 SRM V1.1 and V2.2 interfaces

Conclusion

- dCache team made good progress towards delivering required functionality
- Achieving production quality of the dCache 1.8 and SRM 2.2 is a highest priority
- New members (BNL, NDGF, OSG, …) strengthen collaboration, expected to contribute to the long success

References

- dCache www.dcache.org
- dCache SRM http://srm.fnal.gov
- SRM Working Group http://sdm.lbl.gov/srm-wg/
- SRM V2.2 spec http://sdm.lbl.gov/srm-wg/doc/SRM.v2.2.html